



Defense Science Board Task Force on Nuclear Simulation

SAIC

Arlington, Virginia

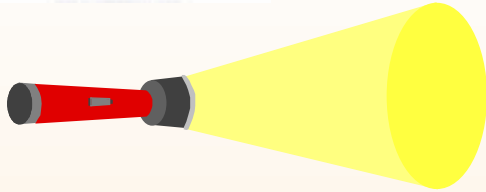
December 1, 1999

DoD Testing Infrastructure Update

**Honorable Philip E. Coyle, III
Director, Operational Test and Evaluation
Office of the Secretary of Defense**



DOT&E Home Page



<http://www.dote.osd.mil>

- Oversight program lists
- Organization
- Annual reports
- Recent operational test reports to Congress
- Briefings, speeches and articles
- Links to testing and other relevant topics



DOT&E Responsibilities

- **Prescribe DoD OT&E and Live Fire T&E (LFT&E) policy**
- **Provide guidance on all OT&E & LFT&E matters**
- **Monitor & review all OT&E & LFT&E in DoD**
- **Report annually to Congress on OT&E & LFT&E**
- **Member of Defense Acquisition Board & Major Automated Information Systems Review Council**
- **Approve test plans for OT&LF oversight programs**
- **Report on programs, before final Beyond-Low Rate Initial Production decision:**
 - Adequacy of OT&E & LFT&E
 - Operational effectiveness and suitability
 - Survivability and lethality
 - To Congress and SecDef



DOT&E Vision



“WEAPONS THAT WORK”

—increased military capability, efficiently integrated into the warfighting force. An effective, efficient DoD T&E team, supported by a state-of-the-art infrastructure, that is vital to effective program management, realistic testing, and value-added evaluations.



DOT&E Mission



DOT&E will ensure that weapons systems are realistically and adequately tested and will provide complete and accurate evaluations of operational effectiveness, suitability, and survivability to the Secretary of Defense, other decision makers in DoD, and Congress. DOT&E will accomplish this by providing policy, test approval, and independent reports.

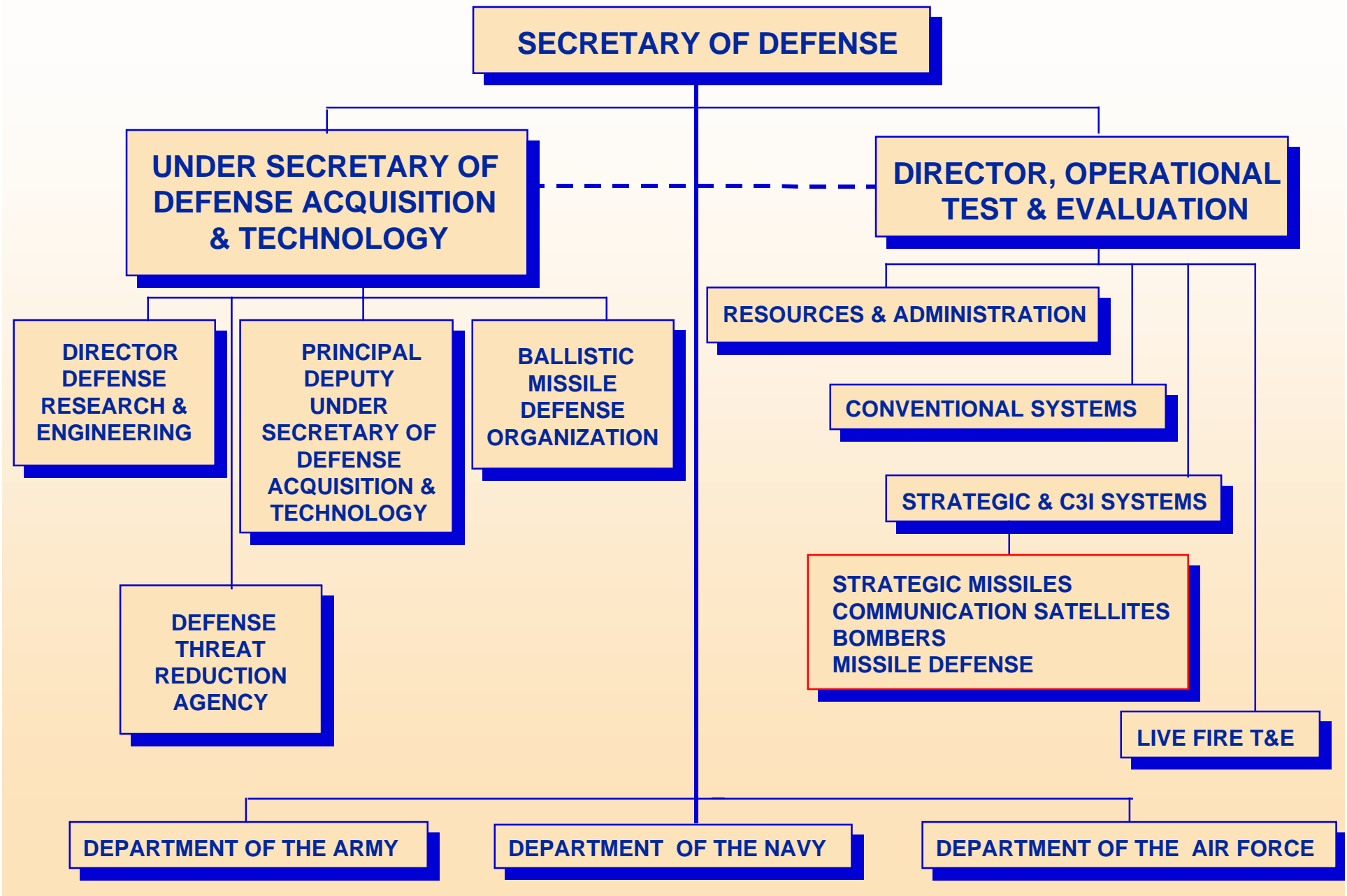


DOT&E Focus



- **Emphasis on Nuclear Survivability T&E will continue**
- **NBC effects mitigation on our systems and personnel (red-on-blue) must be validated**
- **Live Fire T&E has two parts:**
 - Examination of the survivability of our developmental weapons platforms to expected threats, and
 - Examination of the lethality of our developmental conventional weapons (all except NBC which are unconventional)
- **The effects of nuclear weapons on the survivability of our developmental and operational platforms (ships, aircraft, space, and land systems) must be understood**

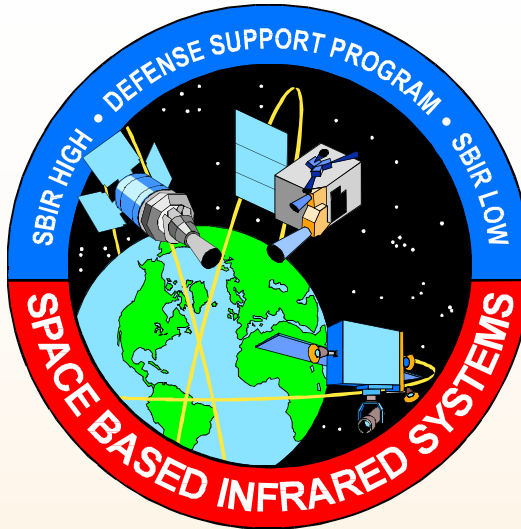
Test & Evaluation Organization





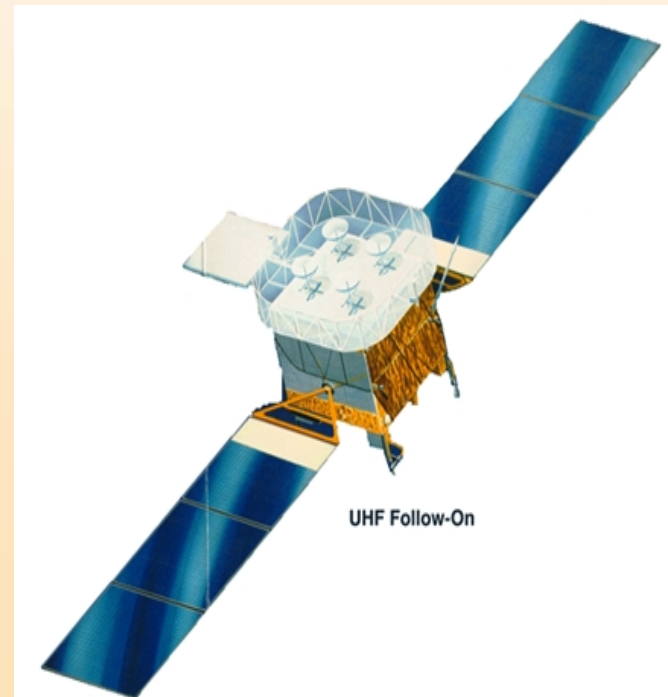
SecDef Themes

- **Early involvement**
- **Use models and simulations effectively**
- **Combine tests when possible**
- **Combine tests and training when possible**
- **Do above for all programs including ACTDs**



Test Planning

- Earlier is Essential
 - “Before the RFP”
 - Contractor has a right to know how system will be evaluated and to contribute to success
- P³I is costly and sometimes impossible (satellites)





M&S

Cradle to Grave Application

- **Concept Exploration**
- **Program Definition & Risk Reduction**
- **Engineering and Manufacturing Development**
- **Production, Fielding/Deployment, & Operational Support**
- **Training**
- **Systems Sustainment, Stockpile Stewardship**
- **P³I, Upgrades & Technology Insertion**

**Test
&
Evaluation**

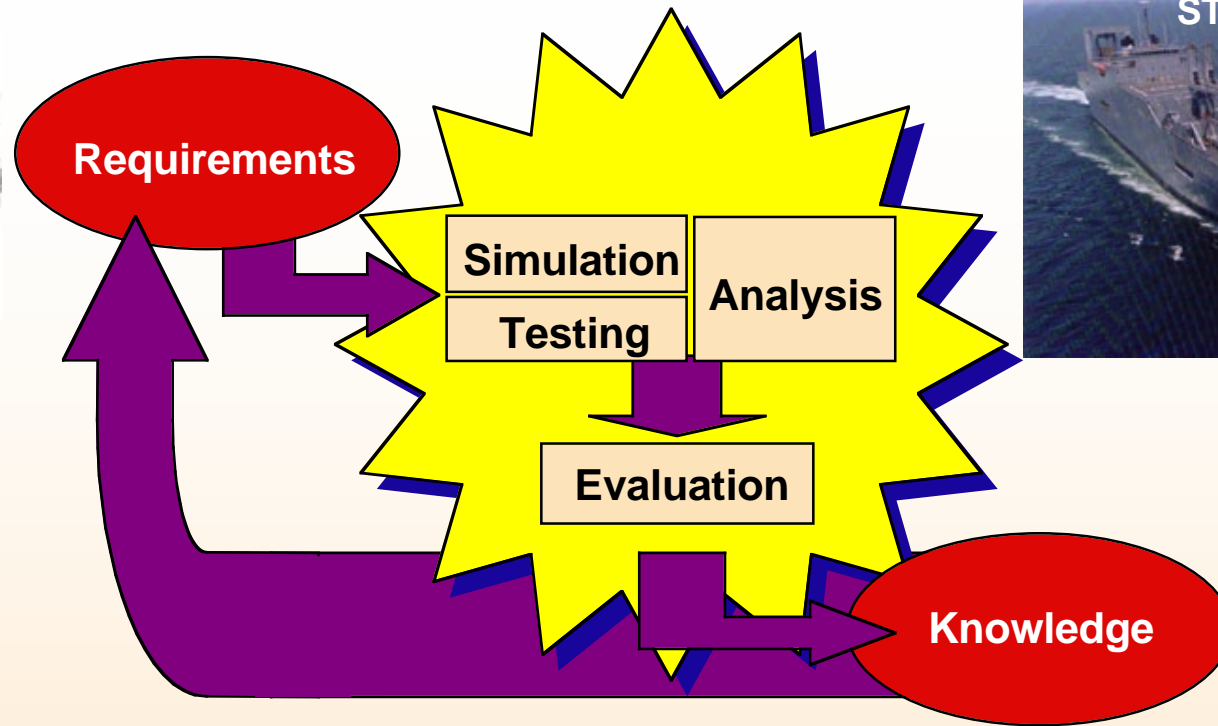


M&S

- Many codes are quite old, authors no longer available and documentation limited
- Some codes are 5,000 Band-Aids deep
- New users unfamiliar with details of assumptions



M&S STEP



Myths

- Operational testers won't use M&S
- M&S is cheap
- M&S and T&E are opposite ends of a balance scale

**Truth is: M&S and T&E are intertwined;
when they are not, neither is effective**



“The Department’s senior leadership is strongly committed to greater use of modeling and simulation, especially models that incorporate real physical underpinnings. With such models, we can actually eliminate certain tests and focus test resources on the areas where our understanding is less. In many cases, we should be conducting tests to validate our models and simulations.”

**Honorable Paul G. Kaminski
fmr USD(A&T)**



Cheyenne Mountain Upgrade (CMU)

■ Nuclear Survivability Requirement

- For existing installations: Maintain hardness of ITW/AA* System
- For new installations: Operate through HEMP

■ DOT&E Activities

- Reviewed, modified, and approved AFOTEC Test Concept
- Approved TEMP
- Monitored on-site activities
- Requested additional regression tests

■ Results

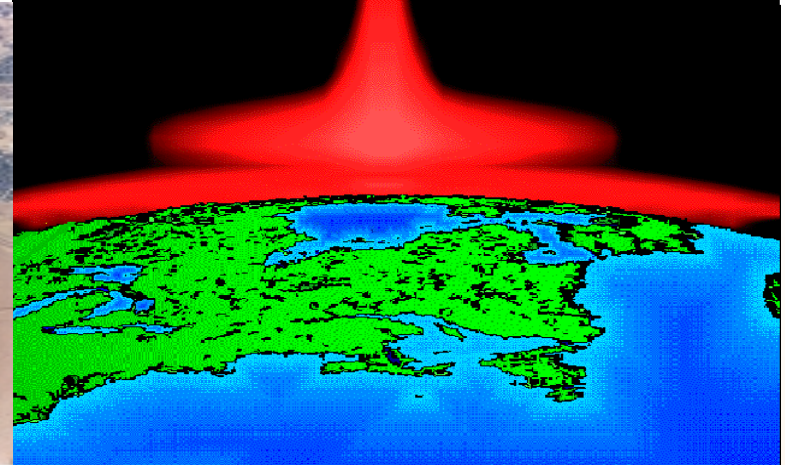
- Current hardness levels had not been degraded, but
- Alerted user to several weak areas
- Requested AFOTEC regression tests of weak areas such as
 - HEMP Penetration paths
 - Operator procedures

*ITW/AA: Integrated Tactical Warning/Attack Assessment



Integrated Operational Nuclear Detection System (IONDS)

- **Space-Based System to detect/warn of NUDETs**
 - Flying on DSP, GPS, SBIRS (future)
- **Replaces current Nuclear Detection System (NDS)**
- **Ground element tested as part of CMU IOT&E**
- **DOT&E Activities**
 - Reviewed, modified, and approved AFOTEC Test Concept
 - Approved TEMP
 - Monitored on-site activities
- **Results**
 - AFOTEC discovered a ten-fold overestimate in NUDET magnitude
 - Error caused by incorrect Interface Control Document (ICD)
 - Potentially serious impact to national decision making and force management
 - STRATCOM, NCA would have had erroneous data
 - Users were alerted, error was corrected, system now effective and suitable



Background

- Nuclear survivability policy has not changed - Honorable John Harvey
- Military systems must operate reliably in nuclear environments
- Congress has mandated that we must test military systems to make sure they work as intended
- UGTs no longer available to assist in hardness validation
- But we are closing or delaying needed AGT facilities

It's time to do a careful study of what's required to meet a range of contingencies



Current and Emerging Threats

- **We face new threats from third world countries**
- **You cannot rule out resurgence of a peer adversary**
- **Conventional systems may have to operate in a nuclear environment**



“Weapons of Mass Destruction (WMD) represent the most important complex of future challenges to national security in the next 10-20 years. Nuclear weapons continue as a powerful deterrent and, in the increasingly multi-polar world, also a major threat, different in many respects from that of the cold war but still of major concern.”

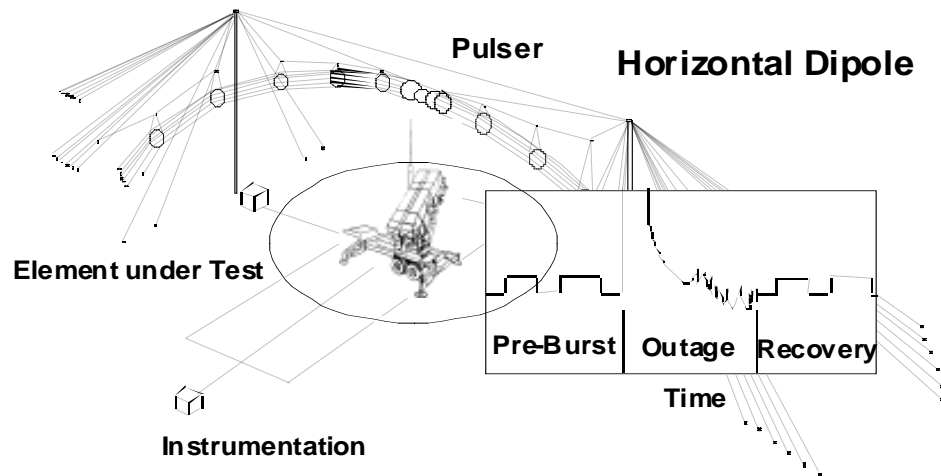
**Defense Reform Initiative Task Force on
The Defense Threat Reduction Agency
28 January 1998**



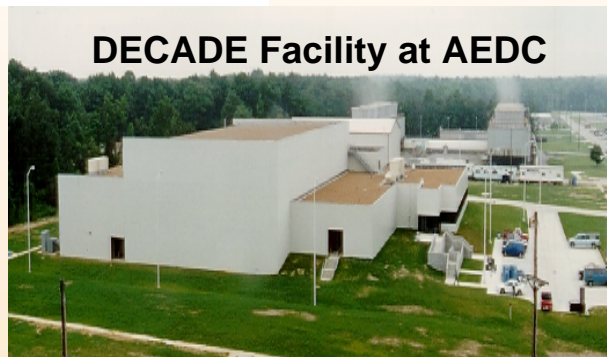
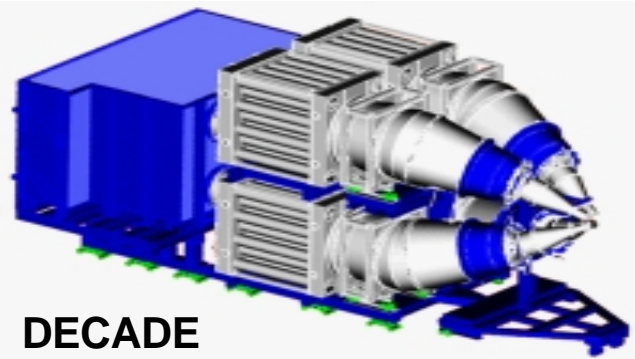
Some Basic Facts



- Necessary to validate system hardness
- Surprises are found in systems level testing
- Small scale/subsystem testing and analysis are important but may not be adequate for systems validation
- Important to preserve T&E infrastructure:
 - People (retain core competencies)
 - Facilities (retain unique and required assets)
 - Processes (maintain systems nuclear hardness and maintenance)



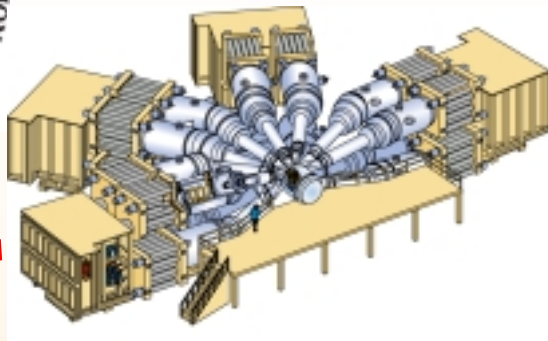
Current Environment



- **Must rely on simulators to validate operability, however**
 - Improved capabilities are needed, e.g., warm x-rays needed to validate and certify survivability of new reentry vehicles
 - New capabilities (NIF, Full DECADE, etc.) are not available to test current systems requirements
- **Important to maintain and improve nuclear simulation capabilities (facilities and M&S)**

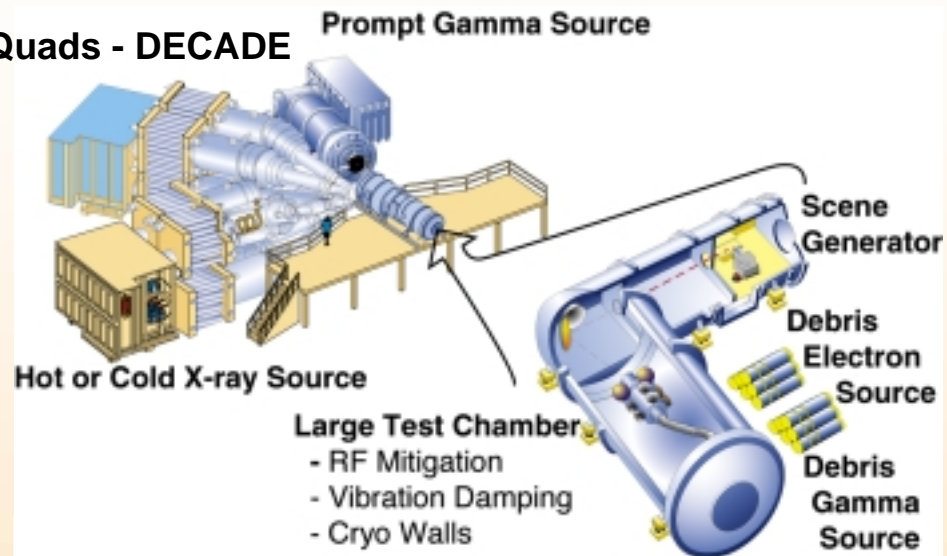


4 Quads - DECADE (Original Concept)



(2nd Quad - DECADE CTEIP Proposal)

2 Quads - DECADE



Test Capability

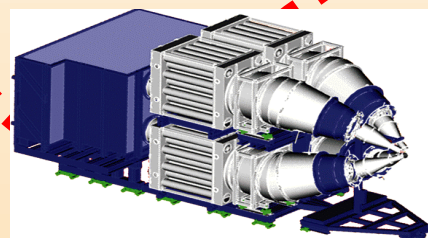
No. of Quad

4

3

2

1



1 Quad - DECADE (Currently Under Development)

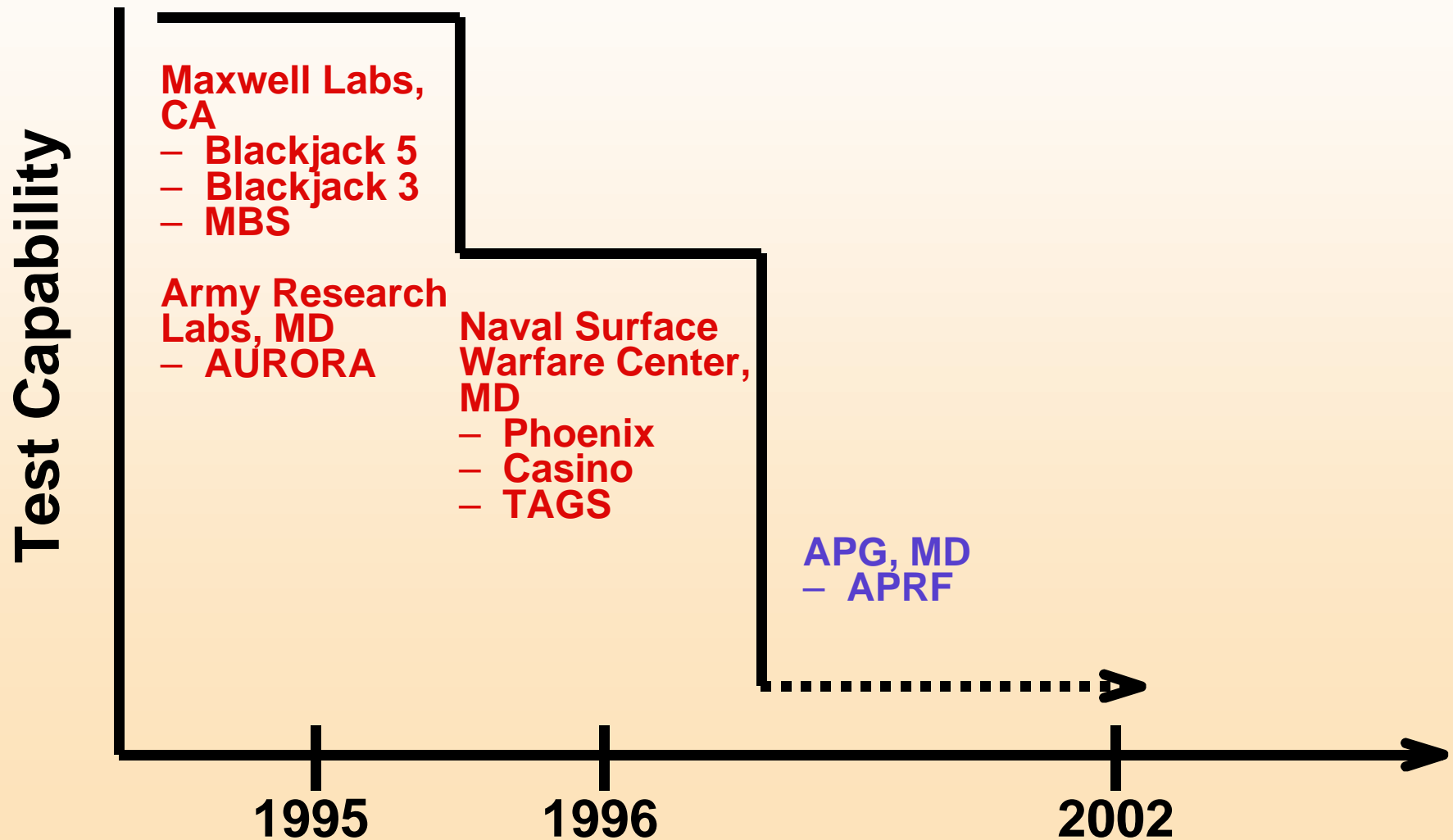
1989

1999 - IOC

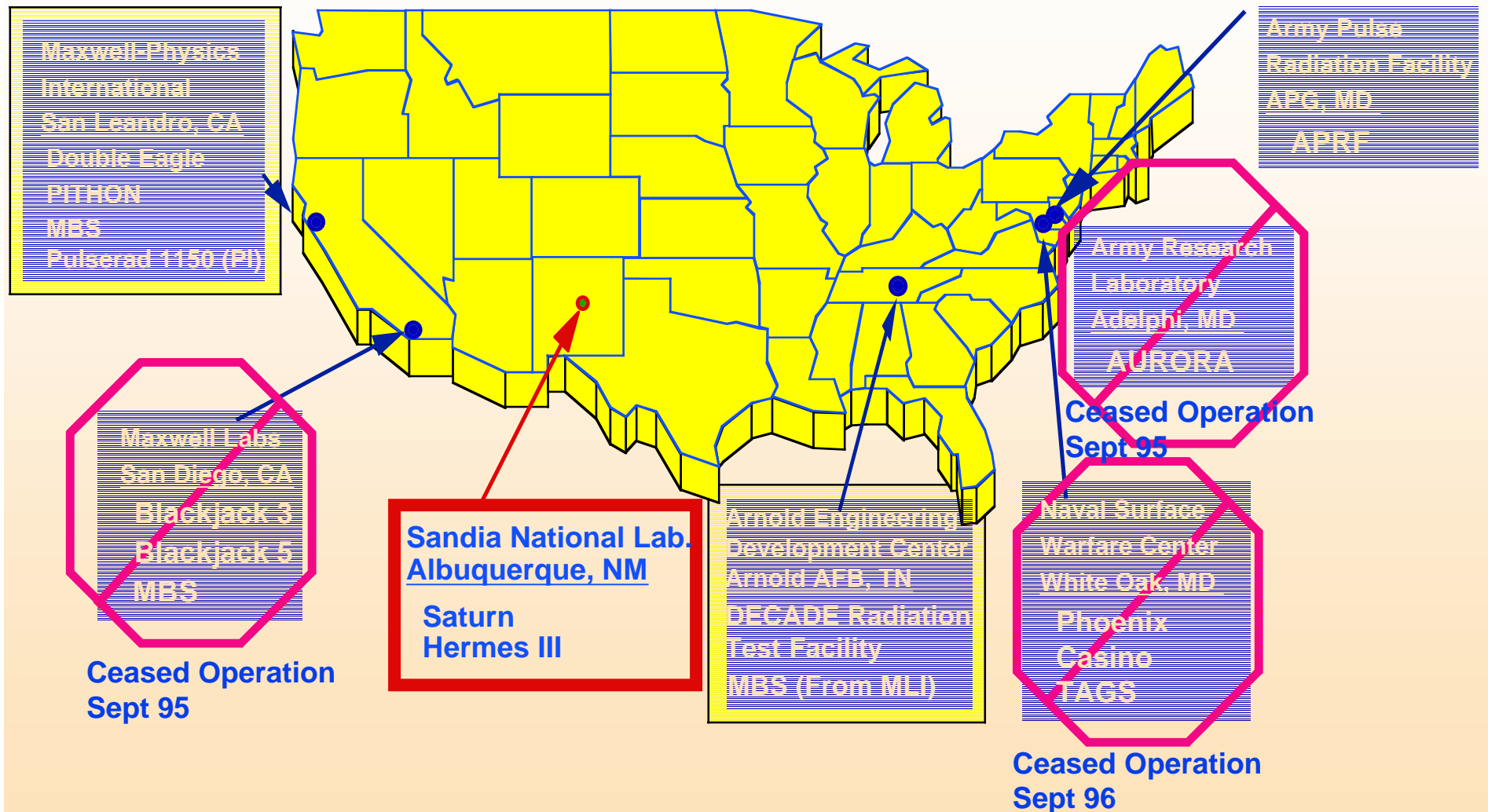
TBD - IOC



Representative DoD Ionizing Radiation Simulators Test Capability Reductions



Representative Ionizing Radiation Simulators Operations, Consolidations and Reductions





NWE T&E Capabilities That Would Be Lost If APRF Is Closed

- Simultaneous Multiple Environments
- Mobile Fast Burst Reactor
- High Fidelity Debris Gamma
- Dial-A-Pulse Threat Environments
- Co-Located Flash X-Ray
- TAGS/CASINO II (not assembled)
- PI-538 (Cold ion source - not developed)
- Size of Test Cell
- Low Background Environment
- High Speed Data System
- Multiple Test Stations
- Inertial Piers
- De-Coupled Rate Table
- Indoor and Outdoor Mobility (X:50M/Z:14M)
- Outdoor Range to 2 Km
- Fall Out Simulation
- NATO Standard Reference Field
- NATO Partnership
- Reactor Characterization/V&V
- Back Up Reactor
- Dual Reactor Operation (in development)
- On-Site Dosimetry
- On-Site Spectroscopy
- Connection to T1/T3 Lines
- Proximity to PMs/Cost

- APRF capabilities are unique and required by the DoD and NATO customers
- APRF should be retained, if possible



Impacted Customers If APRF Is Closed

■ Strategic

- BMDO, USA SMDC - National Missile Defense
- USAF BMO - Minuteman III
- NSWC - Standard Missile 3 (LEAP)

■ Tactical

- NSWC - Standard Missile 2 plus Fleet Satellite Communication
- USA PM NBC - Soldier Protection
- USA PEO GCSS - Family of Armored Vehicles
- NATO Partnership (Canada, France and Germany) - Armored Vehicles
- NATO Partnership (Canada, France, Germany, United Kingdom, Belgium, Italy) - Soldier Protection

■ Intelligence

- USA NGIC - Foreign Material Exploitation
- USAF - Various Satellite-Based Platforms for Intelligence, Communication and Early Warning (including MILSTAR and SBIR)

■ Phenomenology - Basis and Applied R&D: Nuclear Weapons Radiation Environments and Damage Mechanisms

- USA SMDC - Neutron Single Event Upset and Debris Gamma
- NATO Partnership - Particularly Canada, France and Germany - Phenomenology
- DSWA - Phenomenology



“There should be concern with the erosion of DoD nuclear core competency, at a rate not justified by the recent changes in the US national security environment. Nuclear weapons will not go away and the US must maintain a credible and competent nuclear capability over the long term. The time scale for planning nuclear competence sustainment should be decades into the future.”

**Defense Reform Initiative Task Force on
The Defense Threat Reduction Agency
28 January 1998**



Radiation Simulator Current & Emerging NWE Customer Base

- **AF Strategic Programs**
 - Air Logistics Command MMIII
 - Air Logistics Command Peacekeeper
- **Navy Strategic Programs**
 - Trident Missile System Program
 - Trident Guidance & Control Programs
 - Trident Re-entry Systems Programs
- **Satellite Programs**
 - AF SBIRS
 - Navy UHF-Follow-on
 - AF Milstar Advanced EHF
 - Global Positioning System
- **NMD Programs**
 - Spaced Based Infrared Systems (SBIRS)
 - Army Ground Based Interceptor (GBI)
- **TMD Programs**
 - Army Theater High Altitude Area Defense (THAAD)
 - Navy Standard Missile II/III

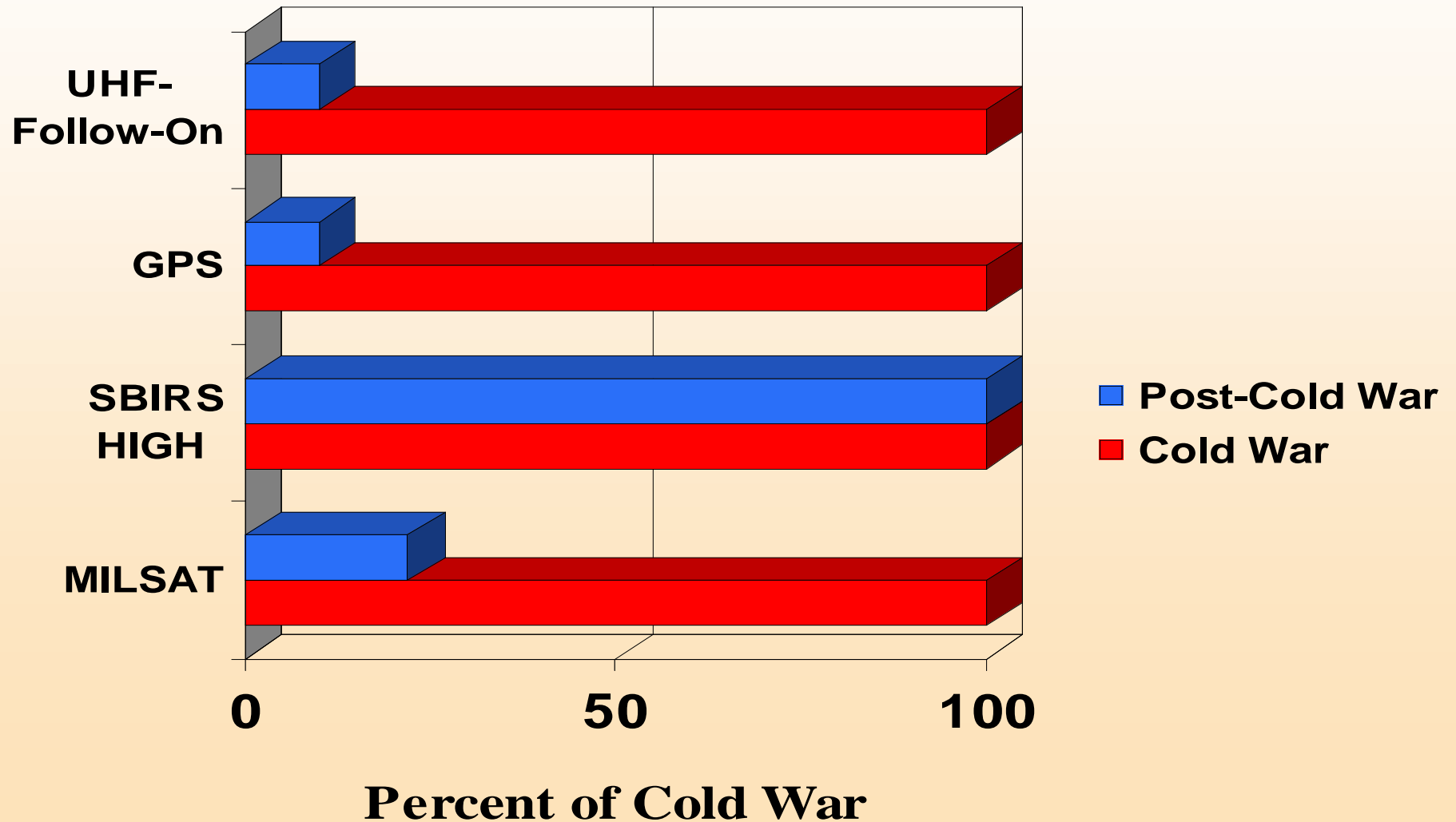


Pressures to Reduce NWE Requirements

- **Changing Perceptions**
 - **Credible Threats**
 - **Multiple Simultaneous Attacks**
- **Budget Pressures**
- **Lowered Test Capabilities**
- **COTS/NDI**
- **Acquisition Reform**



NWE Requirements

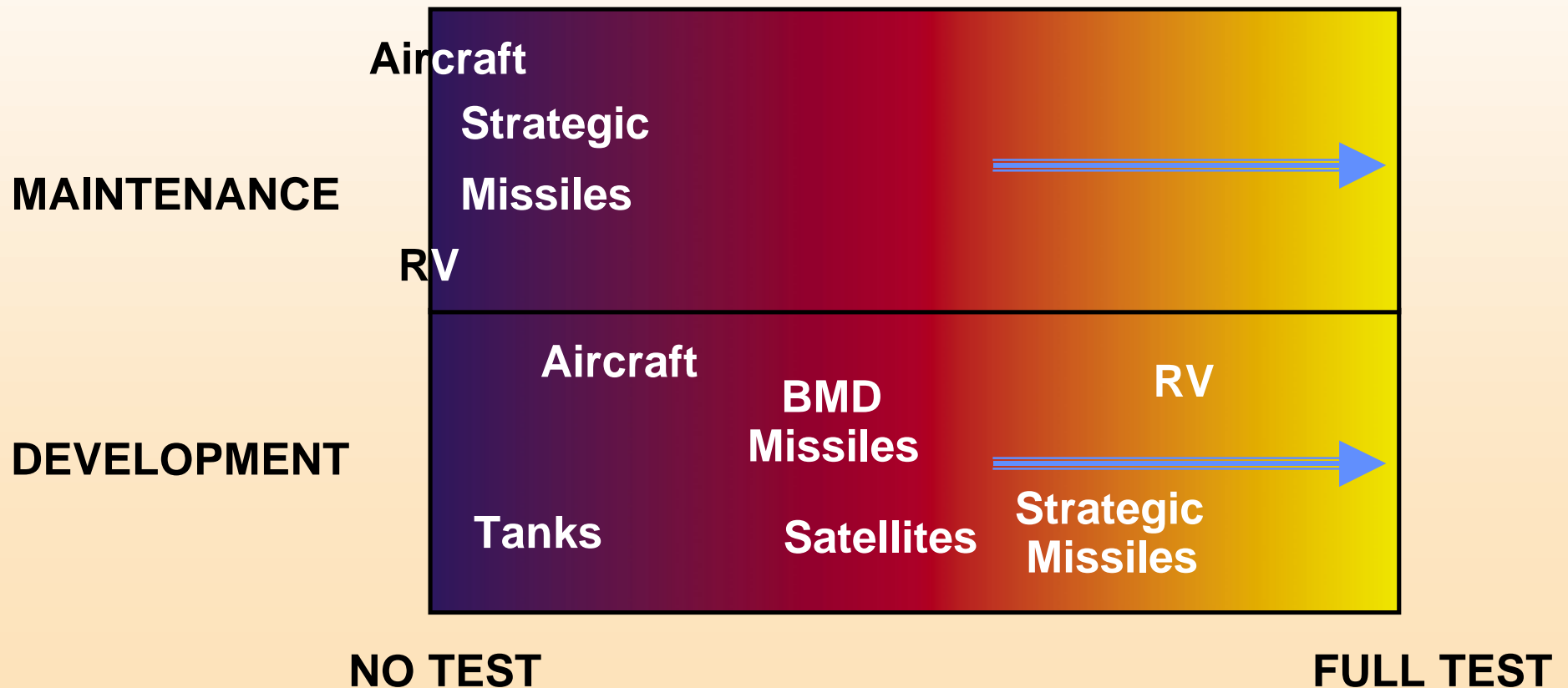




The Future Must Move to Full System Testing to Both Validate and Maintain Hardness

PRESENT

FUTURE





T&E Restructuring

- **Vision 21 and the DoD Reform Initiative Directive (DRID)**
- **DRID will restructure Labs and T&E facilities**
 - Focus on requirements
 - Impacts the DoD/DoE nuclear hardening community
- **DOT&E will be an active participant**
 - Coordinate and oversee identification of cross-Service opportunities for RDT&E restructuring
 - Co-Chair all T&E reviews



Vision 21

DOT&E Objectives

- Retain essential land, air and sea space
 - and frequency spectrum
- Retain critical/unique test facilities
- Requirements based workload
 - No arbitrary reduction in testing capability
 - Plan for range of contingencies

Earn new investment in T&E



“Nuclear weapons will not go away and the US must maintain a credible deterrent capability. Given the changes in the global security environment and in national nuclear policy, DoD must posture for long-term sustainment of nuclear deterrent capability, including delivery systems, technology, support infrastructure, and related expertise. To some extent this is the DoD analogy of the DoE stockpile stewardship.”

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Hardness Maintenance

- Nuclear system lifetimes dramatically extended
- Hardness can erode through aging and upgrades
- Life cycle system hardness testing now more important



“Expertise can only be anticipated based on deep technical understanding and recent hands-on experience in the technical areas. A quotation from William James (c. 1899) is an appropriate reminder.”

“Laboratory work and shop work give honesty; for when you express yourself by making things, and not by using words, it becomes impossible to dissimulate your vagueness or ignorance by ambiguity”

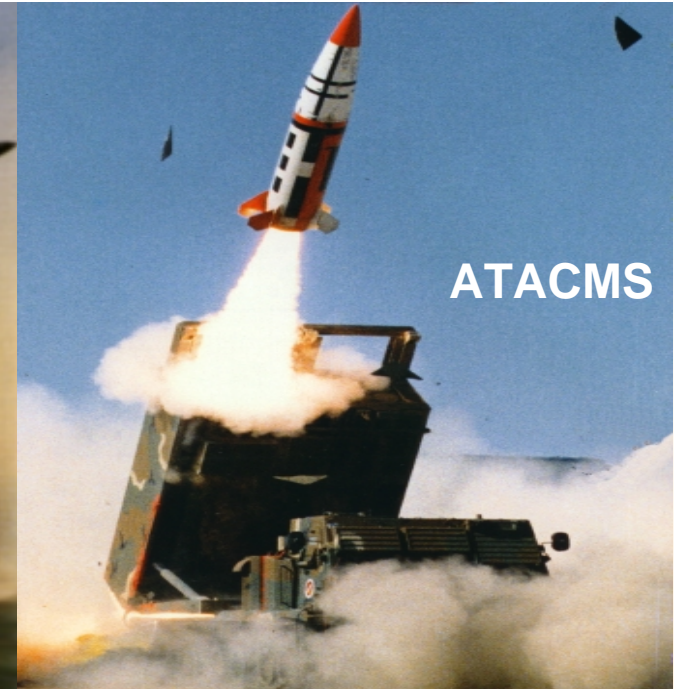
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Basic Conclusions of Review

- ¥ **Re-energize DoD countering of the WMD threat**
 - D **Provide coherent foundation**
 - D **Focus existing activities**
 - D **Develop new initiatives**
- ¥ **Make importance of the problem clear to all**
- ¥ **Reverse decline of DoD nuclear attention and expertise**



- ¥ **Clear mission definition, charter**
- ¥ **Top level support**
- ¥ **Establish to succeed**
- ¥ **Minimum non-core-mission activities**



The Bottom Line

- Vital to preserve nuclear simulation capabilities
 - DTRA has full responsibility
- DOT&E is a strong advocate of NWE T&E
- DOT&E will ensure that nuclear survivability is properly addressed



THAAD

Conclusions



Navy Area

- **Must maintain and update the T&E infrastructure to support NWE testing**
- **Must maintain NWE test requirements**
- **Success requires new investment in T&E and M&S**
- **M&S and T&E are mutually supportive and are intertwined**
- **Test and certification will involve system level M&S & T&E**
- **Must make it happen (TEMP is a place to inject)**

“Testing is the conscience of acquisition.”

**Honorable William J. Perry
fmr Secretary of Defense**





“America’s military men and women must have the best leadership, training, weapons and support, and I am committed to seeing that they do.”

**Honorable William S. Cohen
Secretary of Defense**